Amendment to the Claims:

1. (original) A Compton deconvolution camera comprising:

a first detection layer and a second detection layer, each to detect events resulting from incident photons;

position sensing logic to determine positions of events in each of the first and second detection layers;

a coincidence detector to detect pairs of coincident events resulting from Compton scattering; and

processing logic to:

for each of a plurality of subsets of the first detection layer, associate data representing events detected for said subset with a distribution of corresponding events in the second detection layer, based on said detected pairs of coincident events,

use a deconvolution function to localize probable source locations of incident photons based on said distributions of corresponding events, and

use said probable source locations to reconstruct an image of an object.

2. (original) A Compton deconvolution camera as recited in claim 1, wherein said deconvolution is performed on the distribution of events in the second detection layer for each said subset of the first detection layer.

3. (original) A Compton deconvolution camera as recited in claim 2, wherein the processing logic performs said association of data by computing Compton scattering angles for the detected pairs of coincident events.

4. (previously amended) A Compton deconvolution camera as recited in claim 1, wherein the first detection layer is disposed to receive the incident photons.

5. (original) A Compton deconvolution camera as recited in claim 4, wherein the image is acquired using a single-photon emission mode.

6. (original) A Compton deconvolution camera as recited in claim 4, wherein the processing logic is configured to collimate the incident photons.

7. (original) A Compton deconvolution camera as recited in claim 1, wherein each of the detection layers comprises an array of solid-state ionization detectors.

8. (original) A Compton deconvolution camera as recited in claim 1, wherein each of the detection layers comprises a scintillator and an array of solid-state photodetectors.

9. (original) A Compton deconvolution camera as recited in claim 1, wherein one of the detection layers comprises an array of solid-state ionization detectors; and another of the detection layers comprises a scintillator and an array of solid-state photodetectors.

10. (original) A Compton deconvolution camera as recited in claim 1, wherein one of the detection layers comprises an array of solid-state ionization detectors; and another of the detection layers comprises a scintillator and an array of photomultiplier tubes.

11. (original) A Compton deconvolution camera as recited in claim 1, wherein one of the detection layers comprises a scintillator and an array of solid-state photodetectors; and another of the detection layers comprises a scintillator and an array of photomultiplier tubes.

12. (original) A Compton deconvolution camera as recited in claim 1, wherein the processing logic is configured to use measured values of absorbed energy in the detected events to reject photons subjected to multiple Compton scattering,

13. (original) A Compton deconvolution camera as recited in claim 1, wherein the processing logic is configured to use measured values of absorbed energy in the detected events to validate the computed Compton scattering angles.

14. (original) A nuclear medicine imaging system comprising:

a plurality of detector heads, each of the detector heads including two substantially parallel detection layers to detect events resulting from incident gamma rays originating from an object containing a radiopharmaceutical agent;

position sensing logic to determine positions of events in each of the detection layers;

a coincidence detector to detect pairs of coincident events resulting from Compton scattering, each pair including one event in each detection layer; and

processing logic to:

for each of a plurality of subsets of one of the detection layers, forward project data representing detected events into a distribution of associated events in the other detection layer, based on said detected pairs,

apply a deconvolution function to the forward-projected data to localize probable source locations of incident gamma rays, and use said probable source locations to reconstruct an image of the object.

15. (previously amended) A nuclear medicine imaging system as recited in claim 14, wherein the incident photons are electronically collimated.

16. (original) A nuclear medicine imaging system as recited in claim 15, wherein the image is acquired using a single-photon emission mode.

17. (original) A nuclear medicine imaging system as recited in claim 15, wherein the processing logic is configured to collimate the incident gamma rays.

18. (original) A nuclear medicine imaging system as recited in claim 14, wherein each of the detection layers in each of the detector heads comprises an array of solid-state ionization detectors.

19. (original) A nuclear medicine imaging system as recited in claim 14, wherein each of the detection layers in each of the detector heads comprises a scintillator and an array of solid-state photodetectors.

20. (original) A nuclear medicine imaging system as recited in claim 14, wherein:

one of the detection layers in each of the detector heads comprises an array of solid-state ionization detectors; and

the other of the detection layers in each of the detector heads comprises a scintillator and: an array of photodetectors.

21. (original) A nuclear medicine imaging system as recited in claim 14, wherein the processing logic is configured to use measured values of absorbed energy in the detected events to reject photons subjected to multiple Compton scattering.

22. (original) A nuclear medicine imaging system as recited in claim 14, wherein the processing logic is configured to use measured values of absorbed energy in the detected events to validate the computed Compton scattering angles.

23. (original) A gamma camera comprising:

a plurality of detection layers, each to detect events resulting from incident photons;

positioning means for determining positions of events in each of the detection layers;

coincidence means for detecting pairs of coincident events resulting from Compton scattering; and

forward-projection means for forward-projecting data representing detected events, for each of a plurality of subsets of one of the detection layers, into a distribution of corresponding events in the other detection layer, based on said detected pairs of coincident events, deconvolution means for applying a deconvolution function to the forward-projected data to localize probable source locations of incident photons, and

reconstruction means for using said probable source locations to reconstruct an image of an object.

24. (original) A gamma camera as recited in claim 23, wherein the forward-projection means comprises means for forward projecting events in one of the detection layers corresponding to a coincident event at a given pixel in another one of the detection layers.

25. (previously amended) A gamma camera as recited in claim 23, wherein one of the detection layers is disposed to receive the incident photons.

26. (original) A gamma camera as recited in claim 25, wherein a second one of the detection layers is disposed to receive photons that have undergone Compton scattering in the first detection layer.

27. (original) A gamma camera as recited in claim 26, wherein the reconstruction means comprises means for reconstructing the image from a single-photon emission mode.

28. (original) A gamma camera as recited in claim 27, further comprising means for collimating the incident photons without using a physical collimator.

29. (original) A gamma camera as recited in claim 24, wherein each of the detection layers each comprises an array of solid-state ionization detectors.

30. (original) A gamma camera as recited in claim 24, wherein each of the detection layers each comprises a scintillator and an array of solid-state photodetectors.

31. (original) A gamma camera as recited in claim 24, wherein one of the detection layers comprises an array of solid-state ionization detectors; and another of the detection layers comprises a scintillator and: an array of solid-state photodetectors or photomultiplier tubes.

32. (original) A gamma camera as recited in claim 24, further comprising means for using measured values of absorbed energy in the detected events to reject photons subjected to multiple Compton scattering.

33. (original) A gamma camera as recited in claim 24, further comprising means for using measured values of absorbed energy in the detected events to validate the computed Compton scattering angles.

34. (original) A Compton deconvolution camera comprising:

a first detection layer to detect events resulting from incident photons, at least some of which undergo Compton scattering;

a second detection layer to detect events resulting from incident photons Compton-scattered in the first detection layer;

first position sensing logic to determine positions of events in the first detection layer, the first detection layer comprising a plurality of pixels;

second position sensing logic to determine positions of events in the second detection layer;

a coincidence detector to detect pairs of coincident events, each pair including an event in the first detection layer and an event in the second detection layer; and

processing logic to for each pixel of the first detection layer, forward-project data representing the detected events into a positional distribution of events in the second detection layer, apply a deconvolution function to the forward-projected

data to localize probable source locations of incident photons, and use said probable source locations to reconstruct an image of an object.

35. (original) A Compton deconvolution camera as recited in claim 34, wherein the deconvolution function is applied to the collective forward-projected data for all pixels of the first detection layer.

36. (previously amended) A Compton deconvolution camera as recited in claim 35, wherein the incident photons are electronically collimated.

37. (original) A Compton deconvolution camera as recited in claim 36, wherein detection of said events is performed using a single-photon emission mode.

38. (original) A Compton deconvolution camera as recited in claim 36, wherein the processing logic is configured to collimate the incident photons.

39. (original) A Compton deconvolution camera as recited in claim 34, wherein the first and second detection layers each comprise an array of solid-state ionization detectors.

40. (original) A Compton deconvolution camera as recited in claim 34, wherein the first and second detection layers each comprise a scintillator and an array of solid-state photodetectors.

41. (original) A Compton deconvolution camera as recited in claim 34, wherein:

one of the first and second detection layers comprises an array of solid-state ionization detectors; and

the other of the first and second detection layers comprises a scintillator and an array of solid-state photodetectors.

42. (original) A Compton deconvolution camera as recited in claim 34, further comprising:

a first pulse height analyzer to measure the energy of events detected in the first detection layer; and

a second pulse height analyzer to measure the energy of events detected in the second detection layer.

43. (original) A Compton deconvolution camera as recited in claim 34, wherein the processing logic is configured to use measured values of absorbed energy in the detected events to reject photons subjected to multiple Compton scattering.

44. (original) A Compton deconvolution camera as recited in claim 34, wherein the processing logic is configured to use measured values of absorbed energy in the detected events to validate the computed Compton scattering angles.

45. (original) A Compton deconvolution camera comprising:

a first detection layer to detect events resulting from incident photons from an object to be imaged, wherein at least some of the incident photons undergo Compton scattering in the first detection layer;

a second detection layer substantially parallel to the first detection layer, to detect events resulting from photons Compton-scattered in the first detection layer;

first position sensing logic to determine two-dimensional positions of events in the first detection layer;

second position sensing logic to determine two-dimensional positions of events in the second detection layer;

a coincidence detector to detect pairs of coincident events, each pair including an event in the first detection layer and an event in the second detection layer;

a first memory to store data representing a positional distribution of the events in the first detection layer belonging to said pairs of coincident events, wherein the first detection layer is represented as a plurality of two-dimensional locations,

a second memory; and

processing logic to compute the Compton scattering angles for the detected pairs of coincident events, accumulate in the second memory, for each said two-dimensional location of the first detection layer, a two-dimensional positional distribution of potentially corresponding coincident events in the second detection layer, apply a deconvolution function to the data in the second memory, for each said two-dimensional location of the first detection layer, to localize probable origins of the incident photons represented by said pairs of coincident events, and back project the processed data to reconstruct an image of the object.

46. (previously amended) A Compton deconvolution camera as recited in claim 45, wherein said incident photons from the object are electronically collimated.

47. (original) A Compton deconvolution camera as recited in claim 46, wherein the image is acquired using a single-photon emission mode.

48. (original) A Compton deconvolution camera as recited in claim 47, wherein the processing logic is configured to collimate the incident photons.

49. (original) A Compton deconvolution camera as recited in claim 45, wherein the first and second detection layers each comprise an array of solid-state ionization detectors.

50. (original) A Compton deconvolution camera as recited in claim 45, wherein the first and second detection layers each comprise a scintillator and an array of solid-state photodetectors.

51. (original) A Compton deconvolution camera as recited in claim 45, wherein:

one of the first and second detection layers comprises an array of solid-state ionization detectors; and

the other of the first and second detection layers comprises a scintillator and an array of photodetectors.

52. (original) A Compton deconvolution camera as recited in claim 45, further comprising:

a first pulse height analyzer to measure the energy of events detected in the first detection layer; and

a second pulse height analyzer to measure the energy of events detected in the second detection layer.

53. (original) A Compton deconvolution camera as recited in claim 45, wherein the processing logic is configured to use measured values of absorbed energy in the detected events to reject photons subjected to multiple Compton scattering.

54. (original) A Compton deconvolution camera as recited in claim 45, wherein the processing logic is configured to use measured values of absorbed energy in the detected events to validate the computed Compton scattering angles.

55. (currently amended) A Compton deconvolution camera comprising:

a first detection layer to detect events resulting from incident photons from an object to be imaged, wherein at least some of the incident photons undergo Compton scattering in the first detection layer;

a second detection layer substantially parallel to the first detection layer, to detect events resulting from photons Compton-scattered in the first detection layer;

a first set of amplifiers to amplify outputs of the first detection layer;

a second set of amplifiers to amplify outputs of the second detection layer;

a first set of analog-to-digital (A/D) converters to digitize the amplified outputs of the first set of preamplifiers;

a second set of analog-to-digital [[(AID)]] <u>(A/D)</u> converters to digitize the amplified outputs of the second set of preamplifiers;

first position sensing logic coupled to receive the digitized, amplified

outputs of the first detection layer, to determine two-dimensional positions of events in the first detection layer;

second position sensing logic coupled to receive the digitized, amplified outputs of the second detection layer, to determine two-dimensional positions of events in the second detection layer;

a coincidence detector to detect pairs of coincident events, each pair including an event in the first detection layer and an event in the second detection layer;

a first pulse height analyzer to measure the energy of events detected in the first detection layer;

a second pulse height analyzer to measure the energy of events detected in the second detection layer;

a first memory to store data representing a two-dimensional positional distribution of the events in the first detection layer belonging to said pairs of coincident events, wherein the first detection layer is represented as a plurality of pixels,

a second memory; and

processing logic to accumulate in the second memory, for each pixel of the first detection layer, a two-dimensional positional distribution of potentially corresponding coincident events in the second detection layer, process the data in the second memory by applying a deconvolution function, for all pixels of the first detection layer, to localize probable origins of the incident photons represented by the pairs of coincident events, compute the Compton scattering angles for the detected pairs of coincident events, and back project the processed data to reconstruct an image of the object.

56. (previously amended) A Compton deconvolution camera as recited in claim 55, wherein said incident photons from the object are electronically collimated.

57. (original) A Compton deconvolution camera as recited in claim 56, wherein the image is acquired using a single-photon emission mode.

58. (original) A Compton deconvolution camera as recited in claim 56, wherein the processing logic is configured to collimate the incident photons.

59. (original) A Compton deconvolution camera as recited in claim 55, wherein the first and second detection layers each comprise an array of solid-state ionization detectors.

60. (original) A Compton deconvolution camera as recited in claim 55, wherein the first and second detection layers each comprise a scintillator and an array of solid-state photodetectors.

61. (original) A Compton deconvolution camera as recited in claim 55, wherein:

one of the first and second detection layers comprises an array of solid-state ionization detectors; and

the other of the first and second detection layers comprises a scintillator and an array of photodetectors.

62. (original) A Compton deconvolution camera as recited in claim 55, wherein the processing logic is configured to use measured values of absorbed energy in the detected events to reject photons subjected to multiple Compton scattering.

63. (original) A Compton deconvolution camera as recited in claim 55, wherein the processing logic is configured to use measured values of absorbed energy in the detected events to validate the computed Compton scattering angles.

64. (original) A method of generating an image of an object, the method comprising:

using a plurality of substantially parallel detection layers to detect events

resulting from incident photons, without using a physical collimator;

determining positions of the events in each of the detection layers;

identifying pairs of said events occurring in coincidence, said pairs resulting from Compton scattering, each said pair including one event from each of the detection layers;

forward-projecting data representing detected events, for each of a plurality of subsets of one of the detection layers, into a distribution of corresponding events in the other detection layer, based on said detected pairs of coincident events;

using a deconvolution function to localize probable source locations of incident photons; and

using the probable source locations to reconstruct an image of an object.

65. (original) A method as recited in claim 64, wherein said using a plurality of substantially parallel detection layers to detect events comprises detecting events in a single-photon mode.

66. (original) A method as recited in claim 64, further comprising electronically collimating the incident photons.

67. (original) A method as recited in claim 64, wherein said forward-projecting comprises forward-projecting a pattern of scintillation events in the second detection layer corresponding to coincident events at a given pixel in the first detection layer.

68. (original) A method as recited in claim 64, wherein each of the detection layers each comprises an array of solid-state ionization detectors.

69. (original) A method as recited in claim 64, wherein each of the detection layers each comprises a scintillator and an array of solid-state photodetectors.

70. (original) A method as recited in claim 64, wherein one of the detection layers comprises an array of solid-state ionization detectors, and another of the detection layers comprises a scintillator and: an array of solid-state photodetectors or photomultipliers.

71. (original) A method as recited in claim 64, further comprising using measured values of absorbed energy in the detected events to reject photons subjected to multiple Compton scattering.

72. (original) A method as recited in claim 64, further comprising using measured values of absorbed energy in the detected events to validate the computed Compton scattering angles.

73. (currently amended) A Compton deconvolution camera comprising:

a first detection layer and a second detection layer, each to detect events resulting from incident photons, the first detection layer disposed to receive incident photons from the object;

position sensing ~~logic to determine~~ means for determining positions of events in each of the first and second detection layers;

a coincidence detector ~~to detect~~ means for detecting pairs of coincident events resulting from Compton scattering; and

processing ~~logic to~~ means for:

for each of a plurality of subsets of the first detection layer, ~~associate~~ associating data representing events detected for said subset with a distribution of corresponding events in the second detection layer, based on said detected pairs of coincident events,

~~use~~ using a deconvolution function to localize probable source locations of incident photons based on said distributions of corresponding events,

~~the processing logic is configured to collimate~~ collimating the incident photons, and

~~use~~ using said probable source locations to reconstruct an image of an object.

74. (currently amended) A Compton deconvolution camera comprising:

a first detection layer and a second detection layer, each to detect events resulting from incident photons;

position sensing logic to determine positions of events in each of the first and second detection layers;

a coincidence detector ~~to detect~~ means for detecting pairs of coincident events resulting from Compton scattering; and

processing ~~logic to~~ means for:

for each of a plurality of subsets of the first detection layer, ~~associate~~ associating data representing events detected for said subset with a distribution of corresponding events in the second detection layer, based on said detected pairs of coincident events,

~~use~~ using a deconvolution function to localize probable source locations of incident photons based on said distributions of corresponding events,

~~use~~ using measured values of absorbed energy in the detected events to validate computed Compton scattering angles, and

~~use~~ using said probable source locations to reconstruct an image of an object.

75. (currently amended) A nuclear medicine imaging system comprising:

a plurality of detector heads, each of the detector heads Including two substantially parallel detection layers to detect events resulting from incident gamma rays originating from an object containing a radiopharmaceutical agent;

position sensing ~~logic to determine~~ means for determining positions of events in each of the detection layers;

a coincidence detector ~~to detect~~ means for detecting pairs of coincident events resulting from Compton scattering, each pair including one event in each detection layer; and

~~processing logic~~ a processor programmed to:

for each of a plurality of subsets of one of the detection layers, forward project data representing detected events into a distribution of associated events in the other detection layer, based on said detected pairs,

apply a deconvolution function to the forward-projected data to localize probable source locations of incident gamma rays,

collimate the incident gamma rays, and

use said probable source locations to reconstruct an image of the object.

76. (currently amended) A nuclear medicine imaging system comprising:

a plurality of detector heads, each of the detector heads including two substantially parallel detection layers to detect events resulting from incident gamma rays originating from an object containing a radiopharmaceutical agent;

position sensing ~~logic to determine~~ means for determining positions of events in each of the detection layers;

a coincidence detector ~~to detect~~ means for detecting pairs of coincident events resulting from Compton scattering, each pair including one event in each detection layer; and

~~processing logic~~ a processor programmed to:

for each of a plurality of subsets of one of the detection layers, forward project data representing detected events into a distribution of associated events in the other detection layer, based on said detected pairs,

use measured values of absorbed energy in the detected events to validate computed Compton scattering angles,

apply a deconvolution function to the forward-projected data to localize probable source locations of incident gamma rays, and

use said probable source locations to reconstruct an image of the object.

77. (previously presented) A gamma camera comprising:

a plurality of detection layers, each to detect events resulting from incident photons;

positioning means for determining positions of events in each of the detection layers;

coincidence means for detecting pairs of coincident events resulting from Compton scattering; and

forward-projection means for forward-projecting data representing detected events, for each of a plurality of subsets of one of the detection layers, into a distribution of corresponding events in the other detection layer, based on said detected pairs of coincident events, deconvolution means for applying a deconvolution function to the forward-projected data to localize probable source locations of incident photons,

processing means for collimating the incident photons, and

reconstruction means for using said probable source locations to reconstruct an image of an object.

78. (currently amended) A gamma camera comprising:

a plurality of detection layers, each to detect events resulting from incident photons;

position~~ing means~~ <u>sensing logic</u> for determining positions of events in each of the detection layers;

coincidence means for detecting pairs of coincident events resulting from Compton scattering; ~~and~~

forward-projection ~~means for~~ <u>logic which</u> forward-~~projecting~~ <u>projects</u> data representing detected events, for each of a plurality of subsets of one of the

detection layers, into a distribution of corresponding events in the other detection layer, based on said detected pairs of coincident events[[,]];

deconvolution ~~means for applying~~ logic which applies a deconvolution function to the forward-projected data to localize probable source locations of incident photons[[,]];

a processor programmed to measure ~~processing means for using measured~~ values of absorbed energy in the detected events to validate computed Compton scattering angles[[,]]; and

reconstruction ~~means for using~~ logic which uses said probable source locations to reconstruct an image of an object.

79. (currently amended) A Compton deconvolution camera comprising:

a first detection layer to detect events resulting from incident photons, at least some of which undergo Compton scattering;

a second detection layer to detect events resulting from incident photons Compton-scattered in the first detection layer;

first position sensing logic to determine positions of events in the first detection layer, the first detection layer comprising a plurality of pixels;

second position sensing logic to determine positions of events in the second detection layer;

a coincidence detector to detect pairs of coincident events, each pair including an event in the first detection layer and an event in the second detection layer; and

~~processing logic to for each pixel of the first detection layer,~~ a processor programmed to:

forward-project data representing the detected events for each pixel of the first layer into a positional distribution of events in the second detection layer,

apply a deconvolution function to the forward-projected data to localize probable source locations of incident photons,

collimate the incident photons, and

use said probable source locations to reconstruct an image of an object.

80. (currently amended) A Compton deconvolution camera comprising:

a first detection layer to detect events resulting from incident photons, at least some of which undergo Compton scattering;

a second detection layer to detect events resulting from incident photons Compton-scattered in the first detection layer;

first position sensing logic to determine positions of events in the first detection layer, the first detection layer comprising a plurality of pixels;

second position sensing logic to determine positions of events in the second detection layer;

a coincidence ~~detector to detect~~ detecting means for detecting pairs of coincident events, each pair including an event in the first detection layer and an event in the second detection layer; and

a processor programmed with ~~processing~~ logic to: ~~for each pixel of the first detection layer,~~

forward-project data representing the detected events for each pixel of the first detection layer into a positional distribution of events in the second detection layer,

apply a deconvolution function to the forward-projected data to localize probable source locations of incident photons,

use measured values of absorbed energy in the detected events to validate computed Compton scattering angles, and

use said probable source locations to reconstruct an image of an object.

81. (previously presented) A Compton deconvolution camera comprising:

a first detection layer to detect events resulting from incident photons from an object to be imaged, wherein at least some of the incident photons undergo Compton scattering in the first detection layer;

a second detection layer substantially parallel to the first detection layer, to detect events resulting from photons Compton-scattered in the first detection layer;

first position sensing logic to determine two-dimensional positions of events in the first detection layer;

second position sensing logic to determine two-dimensional positions of events in the second detection layer;

a coincidence detector to detect pairs of coincident events, each pair including an event in the first detection layer and an event in the second detection layer;

a first memory to store data representing a positional distribution of the events in the first detection layer belonging to said pairs of coincident events, wherein the first detection layer is represented as a plurality of two-dimensional locations,

a second memory; and

processing logic to:

compute the Compton scattering angles for the detected pairs of coincident events,

accumulate in the second memory, for each said two-dimensional location of the first detection layer, a two-dimensional positional distribution of potentially corresponding coincident events in the second detection layer,

apply a deconvolution function to the data in the second memory, for each said two-dimensional location of the first detection layer,

collimate the incident photons,

localize probable origins of the incident photons represented by said pairs of coincident events, and

back project the processed data to reconstruct an image of the object.

82. (currently amended) A Compton deconvolution camera comprising:

a first detection layer to detect events resulting from incident photons from an object to be imaged, wherein at least some of the incident photons undergo Compton scattering in the first detection layer;

a second detection layer substantially parallel to the first detection layer, to detect events resulting from photons Compton-scattered in the first detection layer;

first position sensing ~~logic to determine~~ means for determining two-dimensional positions of events in the first detection layer;

second position sensing ~~logic to determine~~ means for determining two-dimensional positions of events in the second detection layer;

a coincidence detector ~~to detect~~ which detects pairs of coincident events, each pair including an event in the first detection layer and an event in the second detection layer;

a first memory ~~to store~~ means for storing data representing a positional distribution of the events in the first detection layer belonging to said pairs of coincident events, wherein the first detection layer is represented as a plurality of two-dimensional locations[[,]]; and

~~a second memory; and~~

processing logic to:

compute the Compton scattering angles for the detected pairs of coincident events,

accumulate in ~~the~~ a second memory means, for each said two-dimensional location of the first detection layer, a two-dimensional positional distribution of potentially corresponding coincident events in the second detection layer,

apply a deconvolution function to the data in the second memory means, for each said two-dimensional location of the first detection layer,

use measured values of absorbed energy in the detected events to validate computed Compton scattering angles,

localize probable origins of the incident photons represented by said pairs of coincident events, and

back project the processed data to reconstruct an image of the object.

83. (currently amended) A Compton deconvolution camera comprising:

a first detection layer to detect events resulting from incident photons from an object to be imaged, wherein at least some of the incident photons undergo Compton scattering in the first detection layer;

a second detection layer substantially parallel to the first detection layer, to detect events resulting from photons Compton-scattered in the first detection layer;

a first set of amplifiers to amplify outputs of the first detection layer;

a second set of amplifiers to amplify outputs of the second detection layer;

a first set of analog-to-digital [[(A/D)]] converters to digitize the amplified outputs of the first set of preamplifiers;

a second set of analog-to-digital [[(AID)]] converters to digitize the amplified outputs of the second set of preamplifiers;

first position sensing logic coupled to receive the digitized, amplified outputs of the first detection layer, to determine two-dimensional positions of events in the first detection layer;

second position sensing logic coupled to receive the digitized, amplified outputs of the second detection layer, to determine two-dimensional positions of events in the second detection layer;

a coincidence detector to detect pairs of coincident events, each pair including an event in the first detection layer and an event in the second detection layer;

a first pulse height analyzer to measure the energy of events detected in the first detection layer;

a second pulse height analyzer to measure the energy of events detected in the second detection layer;

a first memory ~~to store~~ <u>means for storing</u> data representing a two-dimensional positional distribution of the events in the first detection layer belonging

to said pairs of coincident events, wherein the first detection layer is represented as a plurality of pixels[[,]]; and

~~a second memory; and~~

~~processing logic~~ a processor programmed to:

accumulate in the ~~second~~ memory means, for each pixel of the first detection layer, a two-dimensional positional distribution of potentially corresponding coincident events in the second detection layer,

process the data in the ~~second~~ memory means by applying a deconvolution function, for all pixels of the first detection layer,

collimate the incident photons.

localize probable origins of the incident photons represented by the pairs of coincident events,

compute the Compton scattering angles for the detected pairs of coincident events, and

back project the processed data to reconstruct an image of the object.

84. (currently amended) A Compton deconvolution camera comprising:

a first detection layer to detect events resulting from incident photons from an object to be imaged, wherein at least some of the incident photons undergo Compton scattering in the first detection layer;

a second detection layer substantially parallel to the first detection layer, to detect events resulting from photons Compton-scattered in the first detection layer;

a first set of amplifiers to amplify outputs of the first detection layer;

a second set of amplifiers to amplify outputs of the second detection layer;

a first set of analog-to-digital [[(A/D)]] converters to digitize the amplified outputs of the first set of preamplifiers;

a second set of analog-to-digital [[(AID)]] converters to digitize the amplified outputs of the second set of preamplifiers;

first position sensing ~~logic~~ means coupled to receive the digitized, amplified outputs of the first detection layer, ~~to determine~~ for determining two-dimensional positions of events in the first detection layer;

second position sensing ~~logic~~ means coupled to receive the digitized, amplified outputs of the second detection layer, ~~to determine~~ for determining two-dimensional positions of events in the second detection layer;

a coincidence ~~detector to detect~~ detecting means for detecting pairs of coincident events, each pair including an event in the first detection layer and an event in the second detection layer;

a first pulse height analyzer ~~to measure~~ means for measuring the energy of events detected in the first detection layer;

a second pulse height analyzer ~~to measure~~ means for measuring the energy of events detected in the second detection layer;

a first memory to store data representing a two-dimensional positional distribution of the events in the first detection layer belonging to said pairs of coincident events, wherein the first detection layer is represented as a plurality of pixels,

a second memory; and

processing ~~logic to~~ means for:

~~accumulate~~ accumulating in the second memory, for each pixel of the first detection layer, a two-dimensional positional distribution of potentially corresponding coincident events in the second detection layer,

~~process~~ processing the data in the second memory by applying a deconvolution function, for all pixels of the first detection layer,

~~use~~ using measured values of absorbed energy in the detected events to validate computed Compton scattering angles,

~~localize~~ localizing probable origins of the incident photons represented by the pairs of coincident events,

~~compute~~ computing the Compton scattering angles for the detected pairs of coincident events, and

back ~~project~~ projecting the processed data to reconstruct an image of the object.

85. (currently amended) ~~A method of~~ An apparatus for generating an image of an object, the ~~method~~ apparatus comprising:

a means for using a plurality of substantially parallel detection layers to detect events resulting from incident photons, without using a physical collimator;

a means for determining positions of the events in each of the detection layers;

a means for identifying pairs of said events occurring in coincidence, said pairs resulting from Compton scattering, each said pair including one event from each of the detection layers;

a means for electronically collimating the incident photons;

a means for forward-projecting data representing detected events, for each of a plurality of subsets of one of the detection layers, into a distribution of corresponding events in the other detection layer, based on said detected pairs of coincident events;

a means for using a deconvolution function to localize probable source locations of incident photons; and

a means for using the probable source locations to reconstruct an image of an object.

86 (currently amended) ~~A method of~~ An apparatus for generating an image of an object, the ~~method~~ apparatus comprising:

a means for using a plurality of substantially parallel detection layers to detect events resulting from incident photons, without using a physical collimator;

a means for determining positions of the events in each of the detection layers;

a means for identifying pairs of said events occurring in coincidence, said pairs resulting from Compton scattering, each said pair including one event from each of the detection layers;

a means for using measured values of absorbed energy in the detected events to validate computed Compton scattering angles;

a means for forward-projecting data representing detected events, for each of a plurality of subsets of one of the detection layers, into a distribution of corresponding events in the other detection layer, based on said detected pairs of coincident events;

a means for using a deconvolution function to localize probable source locations

of incident photons; and

a means for using the probable source locations to reconstruct an image of an object.